LLNL Environmental Restoration Division (ERD)
Standard Operating Procedure (SOP)

ERD SOP 4.4: Guide to the Handling, Packaging, and Shipping of Samples—Revision: 5

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ENVIRONMENTAL RESTORATION DIVISION
CONTROLLED COPY
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THIS IS A RED STAMP
ERD

APPROVALS: **Date**

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1.0 PURPOSE

The purpose of this SOP is to define the steps required to properly package and ship environmental samples to analytical laboratories and off-site vendors. The transportation of samples must be designed to protect the integrity of the sample, prevent any detrimental effects from the potentially hazardous nature of the samples, and comply with applicable regulations.

2.0 APPLICABILITY

This procedure is applicable to handling, packaging, and shipping samples for the ERD and Operations and Regulatory Affairs Division (ORAD) samples handled, packaged, and shipped by ERD.

3.0 REFERENCES

3.1 Code of Federal Regulations, 40 CFR ch. 1 (7-1-92 Edition), Part 136.3, Office of the Federal Register, National Archives and Records Administration, U.S. Govt. Printing Office, Superintendent of Documents, Mail Stop SSOP, Washington, D.C. 20402-9328.

3.2 Code of Federal Regulations, 49 CFR, Parts 171 and 172.101, Section 8, Office of the Federal Register, National Archives and Records Administration, U.S. Govt. Printing Office, Superintendent of Documents, Mail Stop SSOP, Washington, D.C. 20402-9328.

3.3 Code of Federal Regulations (CFR, 1991b) 40 Part 261.4 (d)(1), Revised July 1, 1991. Office of the Federal Register, National Archives and Records Administration, U.S. Govt. Printing Office, Superintendent of Documents, Mail Stop SSOP, Washington, D.C. 20402-9328.

3.4 Mazzullo, E. T. (2003), "Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180)," letter to Henry L. Longest II, U.S. EPA, dated February 13, 2003, from E. T. Mazzullo, Director, Office of Hazardous Materials Science, U.S. Department of Transportation Research and Special Programs Administration, Washington, D.C.

4.0 DEFINITIONS

See SOP Glossary.

5.0 RESPONSIBILITIES

5.1 Division Leader

The Division Leader's responsibility is to ensure that all samples packaged and shipped for the ERD comply with all pertinent regulations and procedures.

5.2 Field Personnel

The field personnel are responsible for properly handling and packaging samples collected for ERD. They are also responsible for delivering samples to the lock box or sampling coordinator (SC) for shipment or delivery to the laboratory in accordance with all applicable internal and external regulations and procedures. They must also ensure that the samples delivered are representative of the original material. The field personnel must also complete, date, and sign in the appropriate sections of the Chain-of-Custody (CoC) and ERD Shipping Forms.

5.3 Sampling Coordinator (SC), Drilling Coordinator (DC), or Subproject Leader (SL)

The SC, DC, or SL is responsible for contacting the ORAD Environmental Analyst when determining whether samples are hazardous or nonhazardous.

6.0 PROCEDURE

When samples collected at a site are classified hazardous or environmental nonhazardous, a distinction between these samples must be made to (1) determine the appropriate procedures for transporting the samples, and (2) protect the health and safety of the shipping and laboratory personnel receiving the samples. Special precautions, procedures, and secondary containment areas within the analytical laboratories will be used when hazardous samples are received.

6.1 Determining the Classification of Samples

The SC, DC, or SL determines the classification of samples based on Sections 6.1.1 through 6.1.3 and disperses this information to the sampler or other personnel responsible for handling and/or shipping of samples.

6.1.1 Hazardous Sample Identification

A hazardous substance is defined by 49 CFR, part 171, Section 8 as a material including its mixtures and solutions that meet the following criteria:

- As listed in the appendix to Section 172.101,
- Is in a quantity, in one package, which equals or exceeds the reportable quantity (RQ) listed in the appendix to Section 172.101, and
- When a mixture or solution is in a concentration corresponding to the RQ of the material. See following table:

	Concentration by weight	
RQ pounds (kilograms)	**Percent**	**Part per million (ppm)**
5000 (2270)	**10**	**100,000**
1000 (454)	**2**	**20,000**
100 (45.4)	**0.2**	**2,000**
10 (4.54)	**0.02**	**200**
1 (0.454)	**0.002**	**20**

Note:

RQ = Reportable quantity.

The following table example lists hazardous substances and corresponding RQs from the appendix to Section 172.01:

Hazardous substance	RQs lb (kg)	Hazardous substance	RQs lb (kg)
Arsenic	**1 (0.454)**	**1,2-Dichloroethene**	**1000 (454)**
Benzene	**10 (4.54)**	**Freon 11**	**5000 (2270)**
Beryllium	**10 (4.54)**	**Hydrochloric acid**	**5000 (2270)**
Chloroform	**10 (4.54)**	**Mercury**	**1 (0.454)**
Chromium	**5000 (2270)**	**Nickel**	**100 (45.4)**
Copper	**5000 (2270)**	**Nitric acid**	**1000 (454)**
1,1-Dichloroethane	**1000 (454)**	**Tetrachloroethene**	**100 (45.4)**
1,2-Dichloroethane	**100 (45.4)**	**Toluene**	**1000 (454)**
1,1-Dichloroethene	**100 (45.4)**	**Trichloroethene**	**100 (45.4)**

Note:

RQ = Reportable quantity.

For example: If you had a substance weighing 1 lb that contained arsenic at 20 mg/kg (ppm), it would be considered hazardous material. Regulations for packaging, marking, labeling, and shipping hazardous material, hazardous substances, and hazardous wastes are promulgated by the U.S. Department of Transportation (DOT) and described in the Code of Federal Regulations (CFR). However, these regulations were not intended to cover the shipment of small quantities (1 kg or less for single packages) or samples collected at hazardous waste sites that are transported to laboratories for testing.

Note: For all materials identified as hazardous waste, contact the Hazardous Waste Management Division.

6.1.2 Non-Hazardous Sample Identification

Environmental samples with an unknown history are not considered hazardous until (1) the analytical laboratory has analyzed the sample and identifies it as hazardous, (2) the personnel suspect the sample is hazardous, or (3) there is doubt of the sample classification. Once this is determined, samples are shipped accordingly.

It may be necessary to preserve samples per SOP 4.3, "Sample Containers and Preservation." Preserved environmental samples considered hazardous must go through the LLNL Shipping Department using their shipping documents, unless they meet the requirements of 40 CFR, Section 136.3, Table II, note #3. This requirement states that the Hazardous Materials Regulations do not apply to the following materials:

- Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater).
- Nitric acid (HNO3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater).
- Sulfuric acid (H2SO4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater).
- Sodium hydroxide (NaOH) in water solutions at concentrations of 0.08% by weight or less (pH about 12.30 or less).

The most recent guidance can be found in a Letter of Clarification on Hazardous Materials Regulations, date stamped Feb. 13, 2003, Ref. No.: 02-0093 (49 CFR parts 100-185). The letter confirms that when environmental samples are preserved (or even over-preserved) they are not corrosive materials subject to hazardous materials regulations (HMR). Four preservatives: Nitric acid, Sulfuric acid, Hydrochloric acid, and Sodium Hydroxide were each tested in an aqueous solution. Based on the test results, samples containing the following "upper limit" concentrations: 0.28 weight percent Nitric acid; 0.38 percent Sulfuric acid; 0.15 weight percent Hydrochloric acid, and 0.20 weight percent Sodium hydroxide, do not meet the definition of corrosive material in 173.136 and are not subject to HMR.

6.1.3 Radioactive Material

Radioactive material is defined by DOT as any material having a specific activity greater than 0.002 microcuries per gram (μCi/g).

6.2 Shipping Procedures

6.2.1 Hazardous Sample Shipment

To ship samples classified as hazardous or materials identified as the U.S. DOT hazardous material other than hazardous waste and radioactive materials, contact the LLNL Shipping Department, Material Distribution Division.

6.2.2 Non-hazardous Sample Shipment

Non-hazardous samples are not subject to the same packaging, labeling, and shipping requirements as hazardous wastes, but to qualify for this exemption the collector must, according to 40 CFR, Part 261.4(d):

A. Comply with DOT, U.S. Postal Service (USPS), other applicable shipping requirements, or

B. Comply with the following requirements if the sample collector determines that DOT, USPS, or other shipping requirements do not apply to the shipment of the sample:

1. Assure that the following information accompanies the sample:
   - Sample collector's name, mailing address, and phone number.
   - Laboratory's name, mailing address, and telephone number.
   - Quantity of sample.
   - Date of shipment.
   - Description of sample.

   Note: These requirements are routinely met by the inclusion of the CoC (Attachment A) documentation that accompanies samples shipped to contract analytical laboratories (see Section 6.2.4).

2. Package the sample so that it does not leak, spill, or vaporize.

When shipping nonhazardous samples via common courier (Federal Express) an LLNL ShipIt Form (Attachment B) is required by the LLNL Shipping Department and must be prepared *in advance* by the ERD Technical Release Representative (TRR). This form must accompany the environmental samples to be shipped. The SC or person responsible for shipping samples, must fill in the date, account number, note the quantity and material type (i.e., soil and/or water, number of ice chests), and certify the document with a signature/date.

When nonhazardous samples are picked up by the analytical laboratory courier or the analytical laboratory is a paying common courier for the shipment, an ERD shipping form (Attachment C) must be filled out completely. This process eliminates the LLNL Shipping Document, yet provides all the pertinent information. The ERD Shipping Form consists of a top page and a bottom carbon copy. The original top page must be sent to the Traffic Office and the bottom copy to ERD's Data Management Team (DMT).

6.2.3 Radioactive Material Shipment

Samples considered as radioactive materials must be shipped through the LLNL Materials Management Section, Engineering Sciences Division.

6.2.4 General Handling, Packaging, and Shipping Instructions

A. Review sample labels. Once the sampling event is completed, verify that all sample bottles have been correctly identified and labeled appropriately (i.e., location, time, date, etc.). Sample containers must have a completed sample identification tag as described in SOP 4.2, "Sample Control and Documentation." DOT marking and labeling is not required for the majority of samples. However, the sample labels of samples preserved with acids (or bases) should indicate that the sample is corrosive.

B. Complete a CoC. A CoC form must accompany all sample packages sent to the laboratories on and off site. Record samples on the CoC form. The instructions to complete this form are presented in SOP 4.2. As in other activities used to support litigation, regulatory agencies must be able to provide the chain of possession and custody of any samples which are offered for evidence, or which form the basis of analytical test results introduced as evidence. Written procedures must be available and followed whenever evidence samples are collected, transferred, stored, analyzed, or destroyed. The primary objective of these procedures is to create an accurate written record which can be used to trace the possession and handling of the sample from the moment of its collection through analysis and its introduction as evidence.

A. A sample is in someone's custody if:

1. It is in one's actual possession, or
2. It is in one's view, after being in one's physical possession, or
3. It is in one's physical possession and then locked up so that no one can tamper with it, or
4. It is kept in a secured area, restricted to authorized personnel only.

When transferring the samples, the transferee must sign and record the date and time on the CoC form. The sample custodian in the field must account for each sample (or group of samples) when custody transfers are made. Individuals who take custody transfers must complete the appropriate section of the CoC form. The pink copy of the CoC must be sent to DMT after samples have been shipped. A copy of the CoC should be mailed or hand-carried to the TRR.

Note: When shipping any samples offsite via the LLNL Shipping Department or when delivering samples to an onsite lab, retain the pink copy of the CoC and provide to DMT.

C. Packaging samples. Properly identified sample containers should be placed inside Ziploc®-type storage bags and sealed, then placed in picnic cooler-type containers. Samples to be shipped must be packed with sufficient incombustible, absorbent cushioning material to minimize the possibility of sample container breakage. Samples that require refrigeration during shipping

should be packed with a sufficient number of Blue Ice packs or bagged ice cubes to keep samples preserved. Temperature blanks are to accompany all samples which require temperature preservation (4° C [degrees centigrade]). They should consist of a 250-ml poly container or equivalent filled with water. The receiving analytical laboratory should be instructed to measure these blanks to ensure sample integrity. The blanks should be requested back from the analytical laboratory to be reused. It should be noted on CoC forms (under the "Remarks" section) that a temperature blank is enclosed in the shipment. If the blank temperature exceeds 4° C ± 2° C (upon sample receipt), the receiving analytical laboratory should notify the SC or other appropriate personnel.

D. Call ahead. The field personnel, SC, or QC Chemist must call the analytical laboratories before shipping samples to verify that they have the capacity to analyze the samples within their hold and turnaround times. Most laboratories can better process samples when they can plan their work load and downtimes. The analytical laboratory must be notified in advance if incoming samples:

1. Require a rapid turnaround time.
2. Are considered hazardous or when high levels of contaminants are suspected.
3. Arrive with short holding times.
4. Are being shipped in large quantities.
5. Are being sent on Fridays or before holidays.

E. Complete Shipping Forms. The form used is based on classification of samples (see Sections 6.1.1 through 6.1.3). A copy of these forms must be sent to DMT.

F. Deliver samples to appropriate shipping location. (Lock box or LLNL shipping as described in Sections 6.2.1 through 6.2.3). LLNL Shipping must receive samples by 2:00 p.m. Samples need to be delivered to the Lock Box by the analytical laboratory courier pickup time. Generally, the courier pickup times are 4:00–4:30 p.m. at the Livermore Site and 4:30 p.m. at Site 300. Call the analytical laboratory to arrange for special or later pickup when necessary. When samples are shipped on Friday, Saturday delivery must be specified on the LLNL Shipping Document. Receipt must be coordinated with the analytical laboratory.

7.0 QA RECORDS

7.1 Chain-of-Custody forms

7.2 Logbooks and field sheets

7.3 Shipping documents

8.0 ATTACHMENTS

Attachment A—Example Chain-of-Custody Form

Attachment B—LLNL Shipping Document

Attachment C—ERD Shipping Form

Attachment A

Example Chain-of-Custody Form

ERD Chain-of-Custody Record and Analytic Instructions

A

Sampled By : _____

Sampler's Employer: _____

Project Name : _____

_____

Analytical Lab Please Fax or Email copies to**:**

name _____ Fax# 925-422-6950 / Email _____

name _____ Fax# 925-422-6950 / Email _____

Requester, (circle one)
S300
WGMG
Livermore

Send all results to:

Attn: ERD DMT L-528
Lawrence Livermore National Laboratory
7000 East Ave.
Livermore, CA 94550

Field Log Book# _____ Page _____ of _____

LLNL Acct. # _____ **Release #** _____

Analytical Laboratory Name _____

Analytical Laboratory Log # _____

_____

*** Analytical Lab, when Email is requested always Email ERD_DMG !**

Sample Identification	Sample Date/Time	Matrix 2 / Container 3	# of Cont.	Study Area	Analysis & Turnaround Required 1	Additional Instructions to Lab / * Remarks *
1						
2						
3						
4						
5						
6						
7						
8						
9						

Signature	Company	Time	Date
Relinquished by			
Received by			
Relinquished by			
Received by			
Relinquished by			
Received by			

1. Enter the number of days or hours for TAT of the official printed report. See Requested Analysis code list for available TAT's for each type of analysis. Example: 24h = 24 hours / 20d = 20 day

2. Sample Matrix Codes: **See list on back of pink copy**

3. Container type codes: **V** = VOA Bottle, **P** = Polyethylene Bottle, **G** = Glass Bottle, **T** = Brass Tube, **B** = Bag, **S** = Stainless Steel Tube, **O** = Other (specify under remarks)

To receive copies of this data from DMT

CC:

Revision 4.7
26-sept-00 ERD

White : Laboratory return to ERD Attn. ERD Data Management Team L-528 | **Yellow : Analytical Lab** | **Pink: Sampler leave with ERD** Attn. ERD Data Management Team L-528 | **Gold: Sampler Leave with TRR**

Attachment B

LLNL ShipIt Form

ShipIt

UNIVERSITY OF CALIFORNIA
LAWRENCE LIVERMORE NATIONAL
LABORATORY

00031679

Request #: 00031679

08/28/2003 09:14:21

Date Required

Ship To:

General Engineering Labs (GEL)
Sample Receiving
Sample Receiving
2040 Savage Rd.
Charleston, SC, 29414
UNITED STATES

Material Value

$0.00

Suggested Shipment

Overnight

Pkg #	*Weight*	*Length*		*Width*		*Height*	*Type*
			X		**X**		
			X		**X**		
			X		**X**		
			X		**X**		
			X		**X**		
			X		**X**		
			X		**X**		
			X		**X**		
			X		**X**		

Attachment C

ERD Shipping Form

A 4001

Environmental Restoration Division
NON-HAZARDOUS ENVIRONMENTAL SAMPLE
SHIPPING REPORT

Date: _____

Destination: (check one)

☐ BC Laboratories Inc.; (BB); 4100 Atlas Court, Bakersfield, CA 93308

☐ Caltest Analytical Laboratory; (CN); 1885 N. Kelly Rd. ; Napa, CA 94558

☐ Thermo Nutech; (TN); 2030 Wright Ave; Richmond, CA 94804

Other _____ _____
Please specify Zip code

These destination laboratories serve as the courier themselves.

Contact: ☐ Rebecca Goodrich 3-8099

Commodity: (check below all that apply)

☐ Aqueous Environmental Samples

☐ Soil Environmental Samples

☐ Solid Environmental Samples

Number of Packages :
(example: 1 ice chest)

Total Weight :
(estimated)

Comments:

_____

_____

_____

Chain of Custody (COC) Accession Numbers: (Upper right hand corner of COC)

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Report Prepared by :

_____ _____ _____
Signature Print name Phone #

Please mail to: The Traffic Office at L-516

5-10-99 Rev 3.1